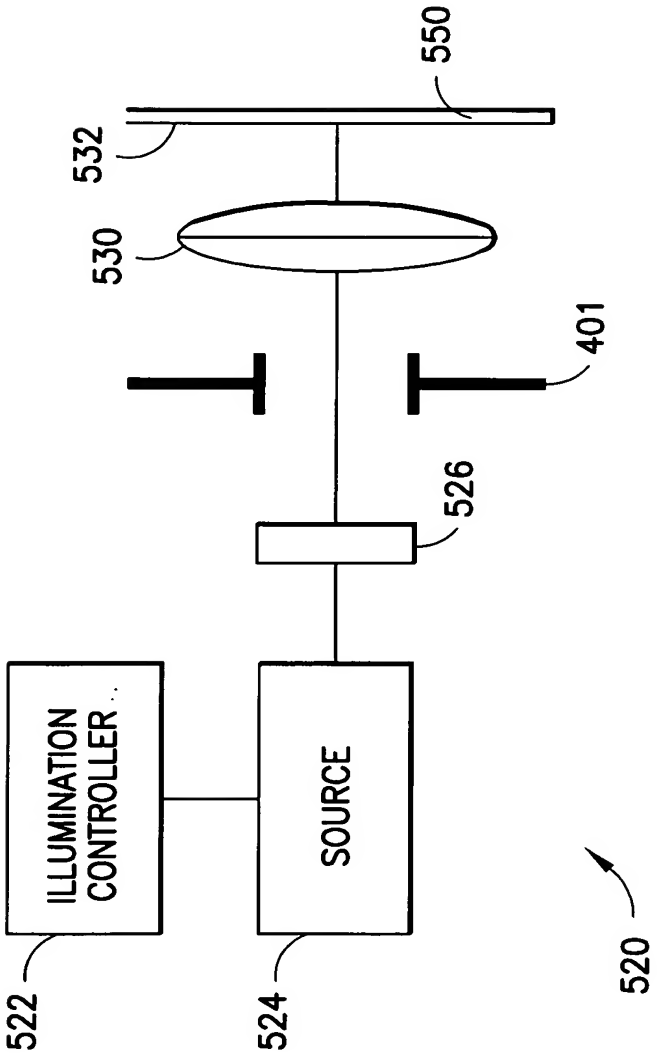


FIG. 1
PRIOR ART

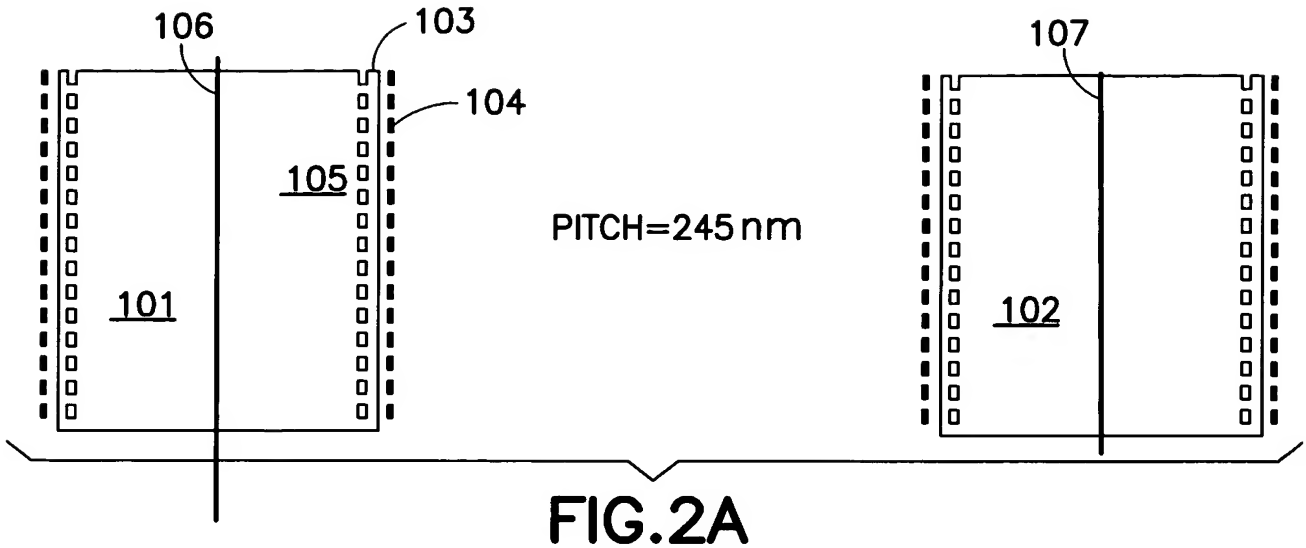


FIG.2A

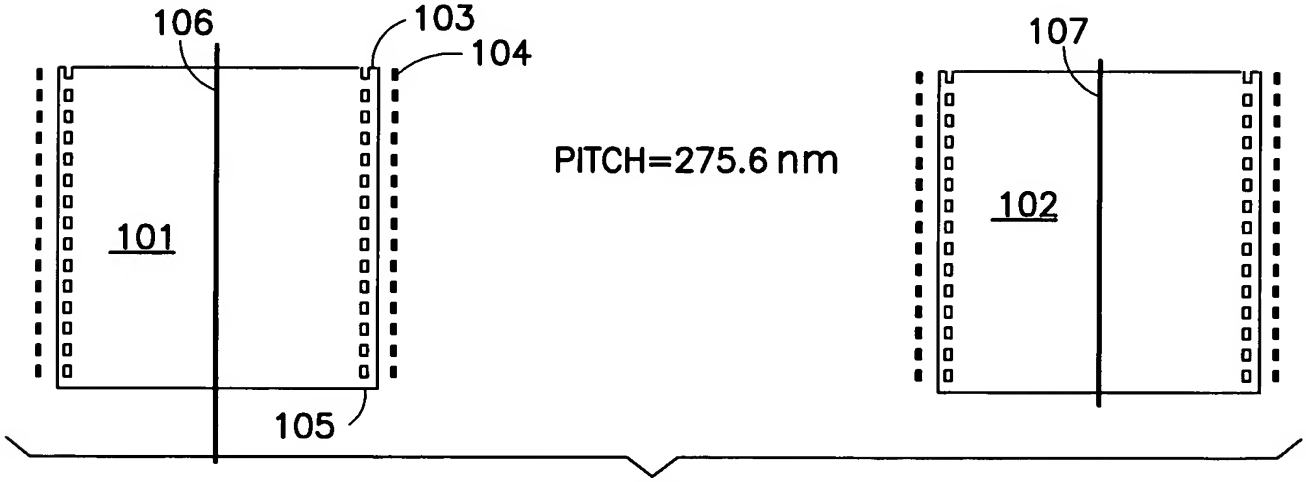


FIG.2B

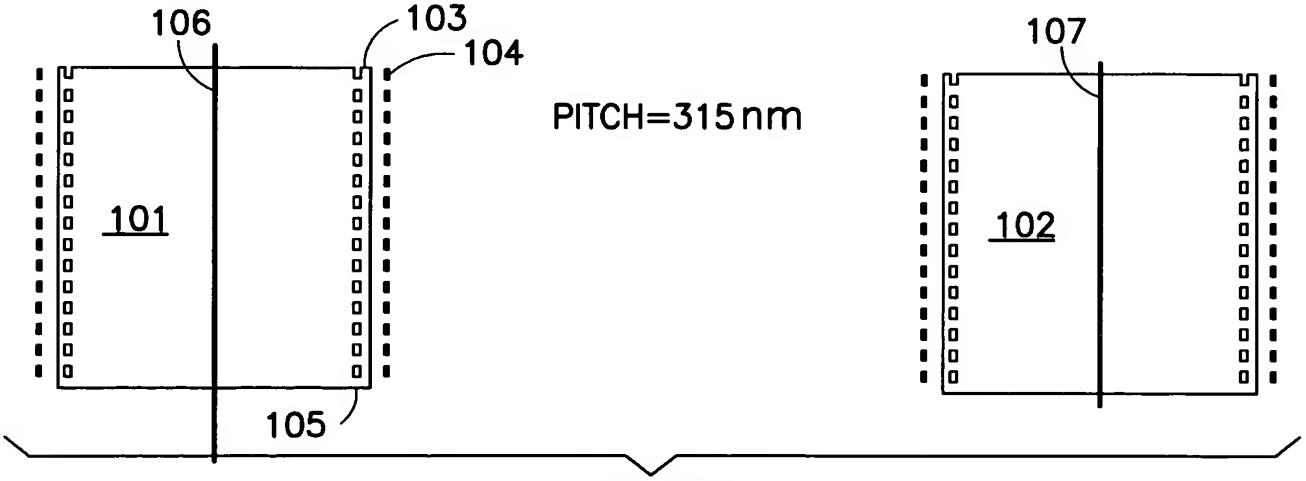


FIG.2C

PITCH=245 nm

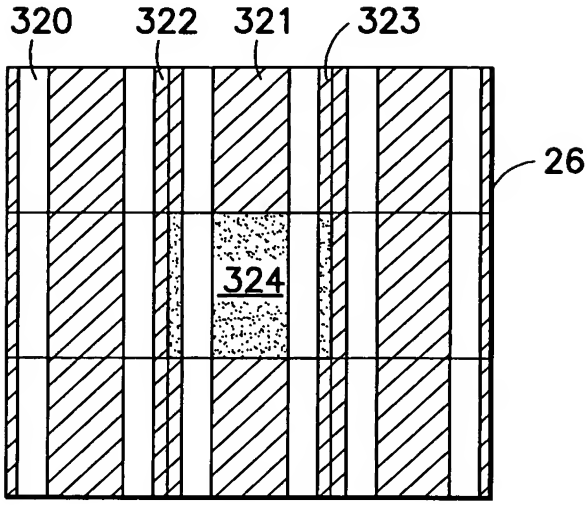


FIG.3A

PITCH=276 nm

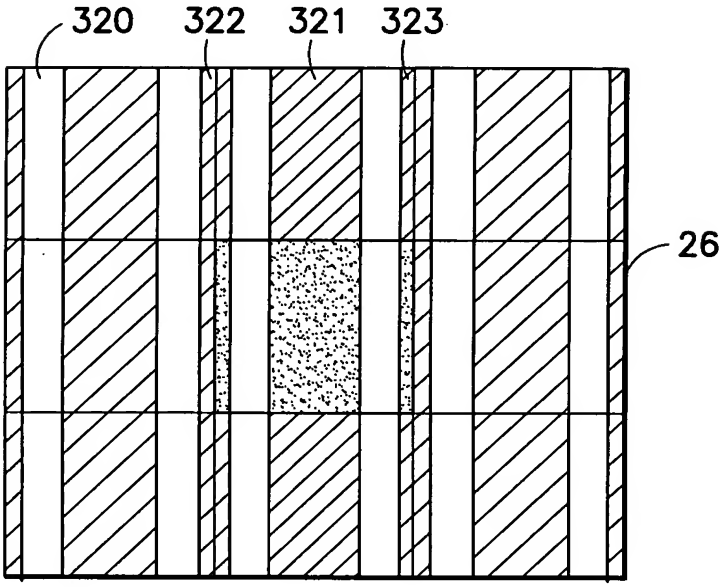


FIG.3B

PITCH=315 nm

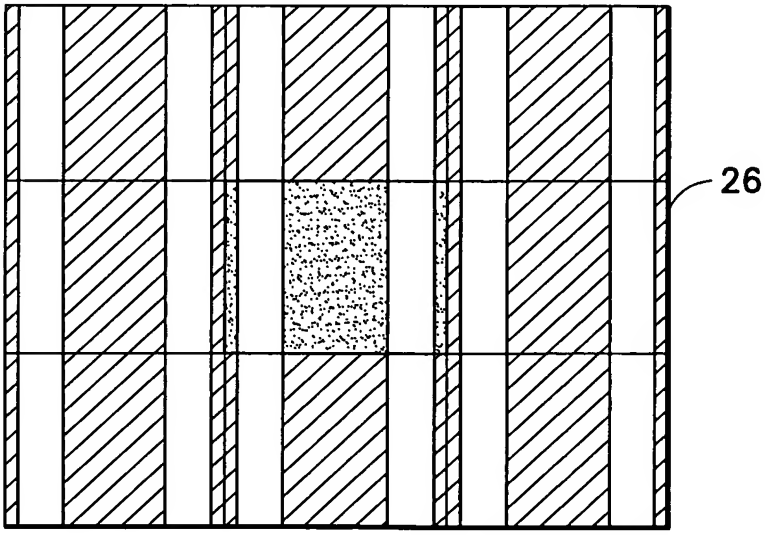


FIG.3C

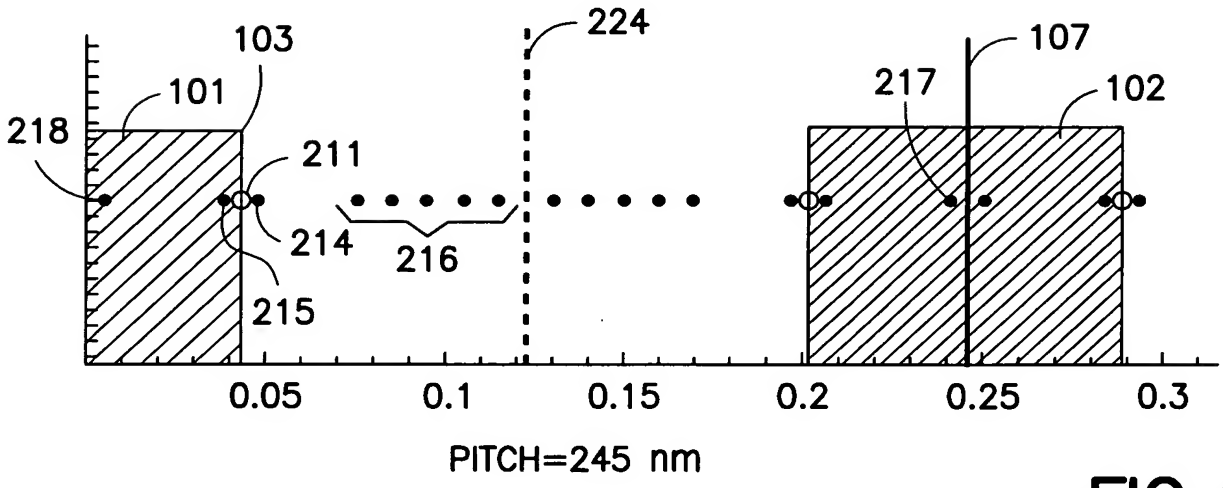


FIG.4A

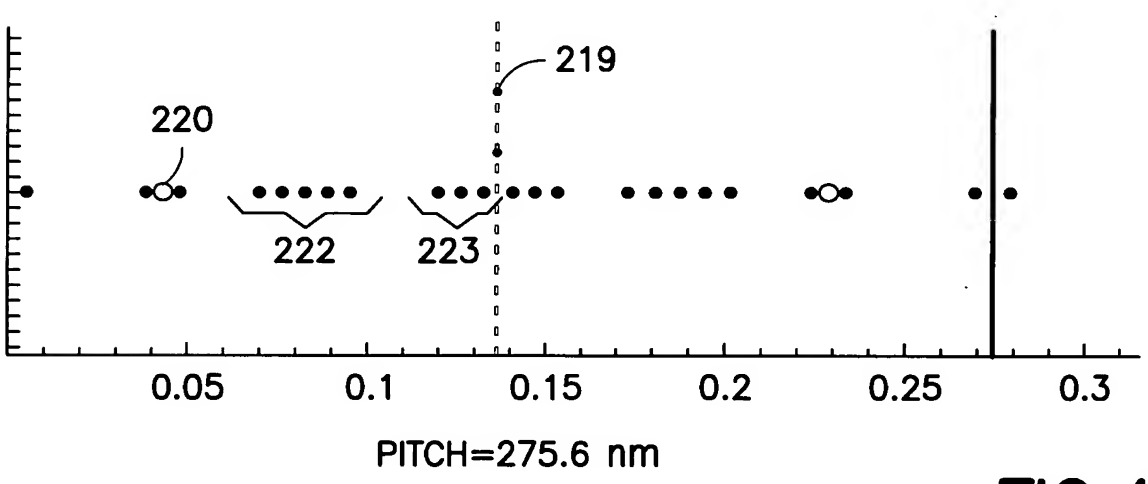


FIG.4B

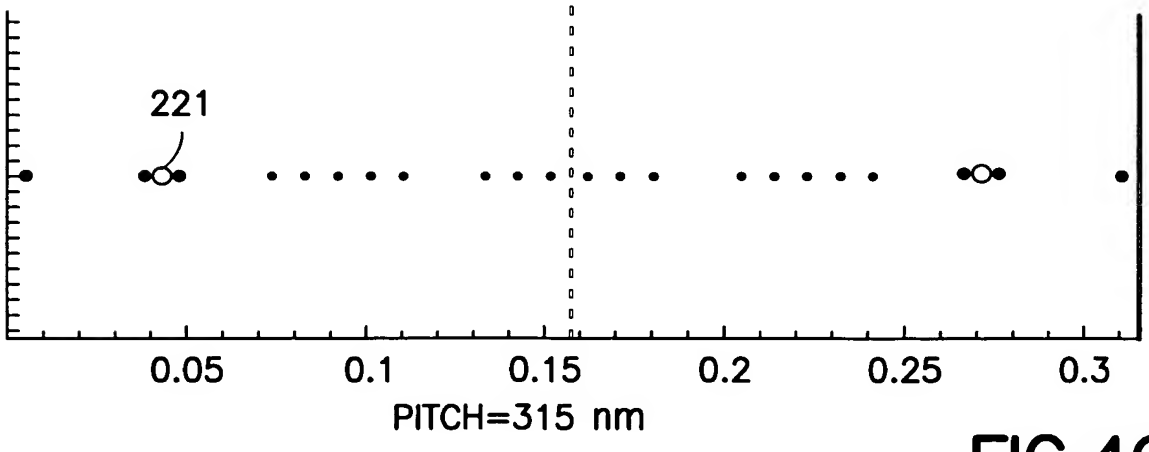


FIG.4C

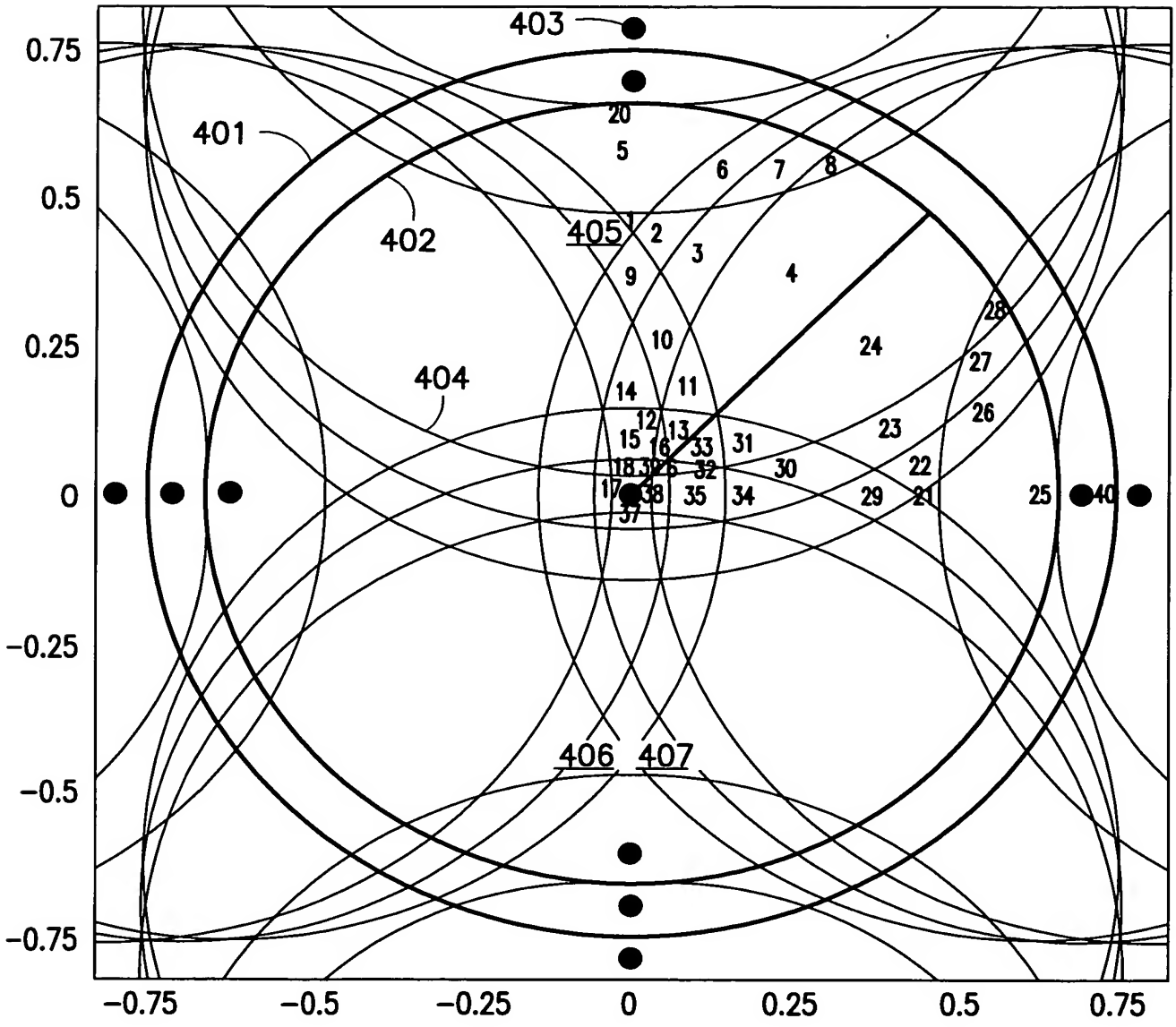


FIG.5
PRIOR ART

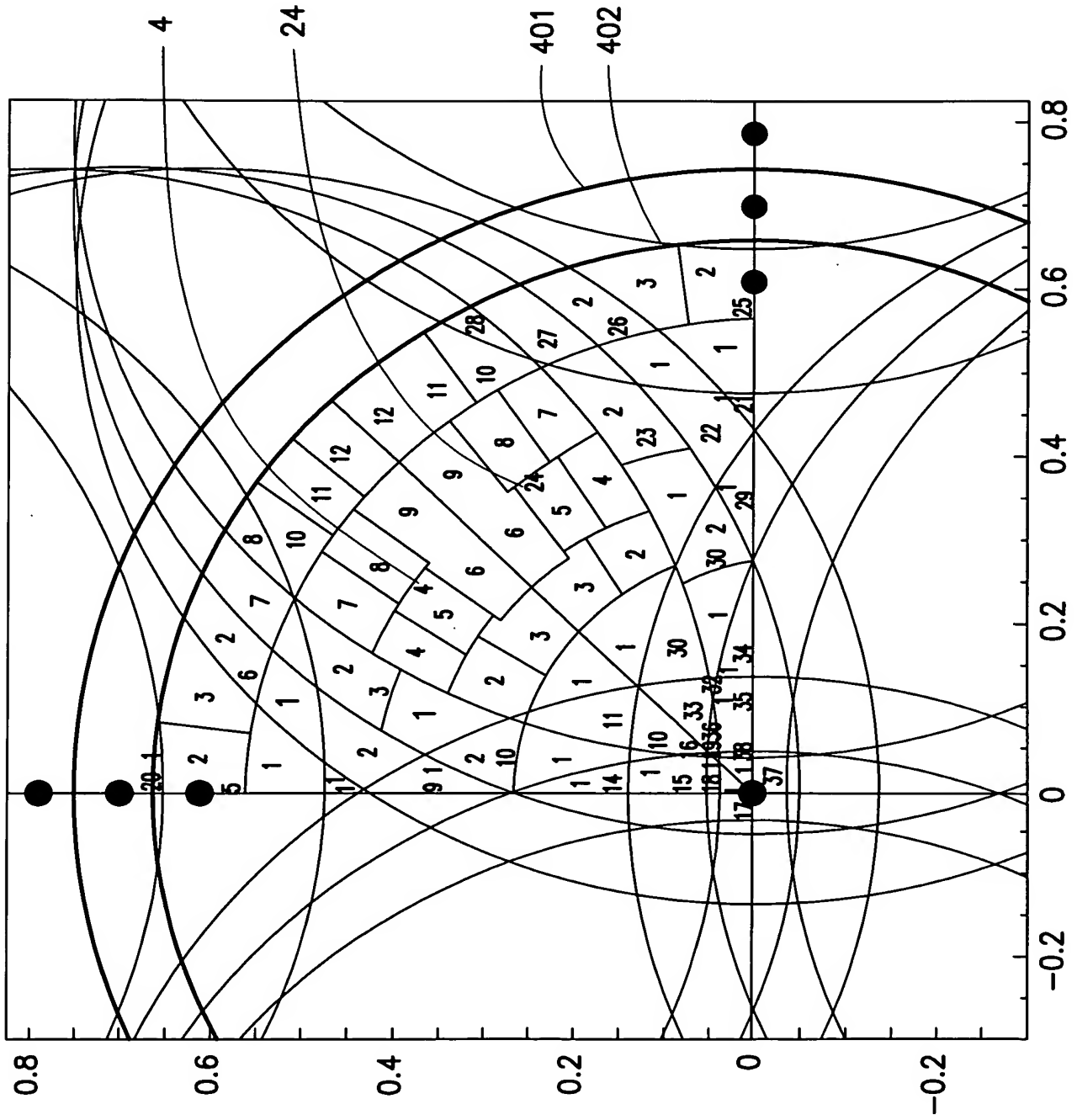


FIG.6

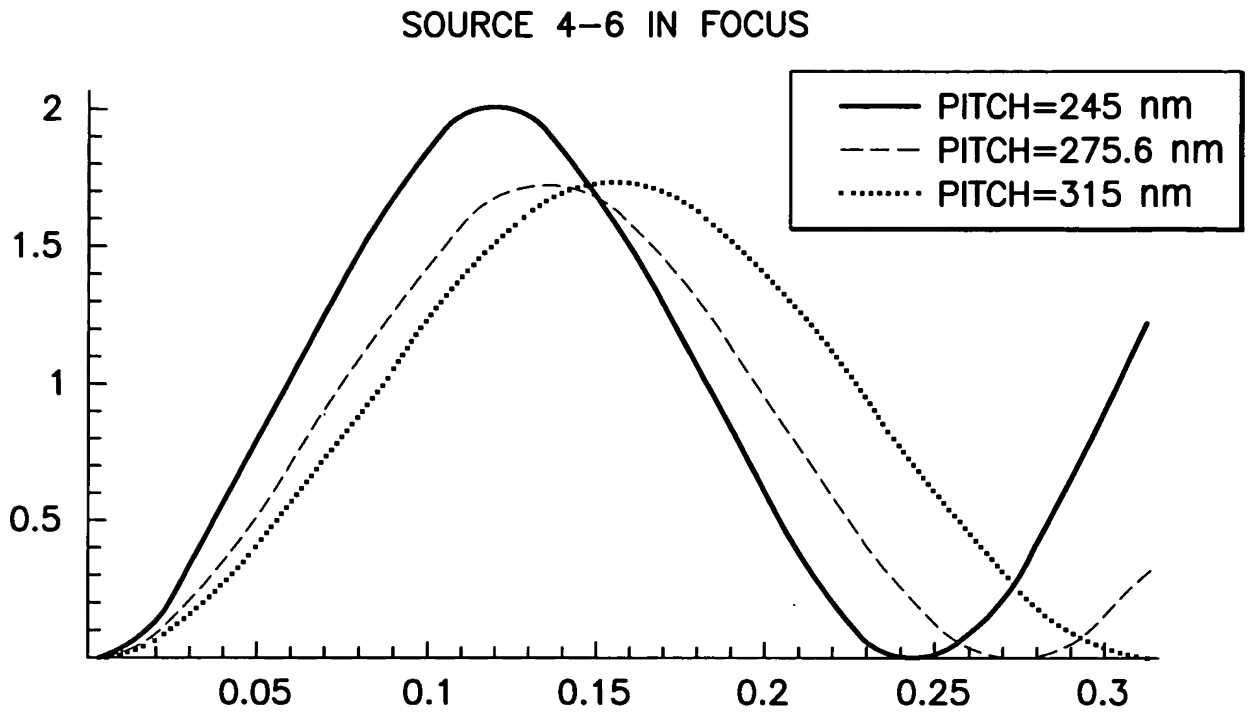

SOURCE 4-6 IN FOCUS
PITCH=245 nm
PITCH=275.6 nm
PITCH=315 nm
2
1.5
1
0.5
0.05
0.1
0.15
0.2
0.25
0.3

FIG.7

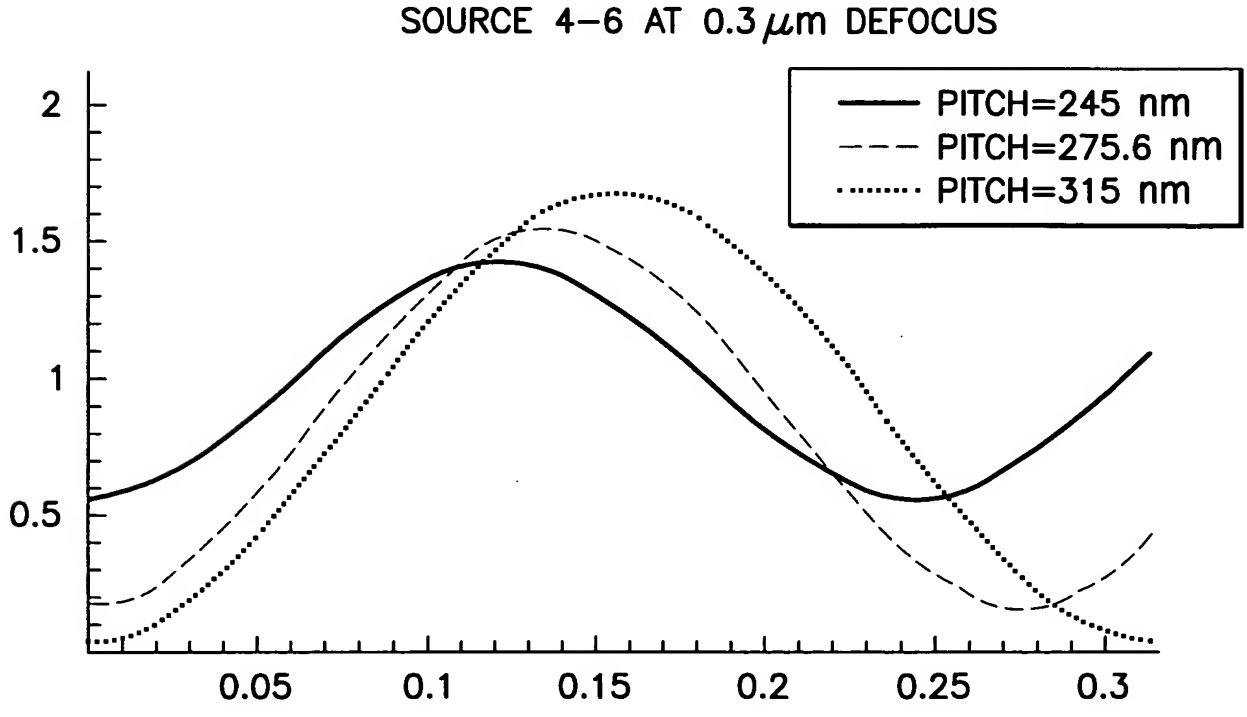

SOURCE 4-6 AT 0.3 μm DEFOCUS
PITCH=245 nm
PITCH=275.6 nm
PITCH=315 nm
2
1.5
1
0.5
0.05
0.1
0.15
0.2
0.25
0.3

FIG.8

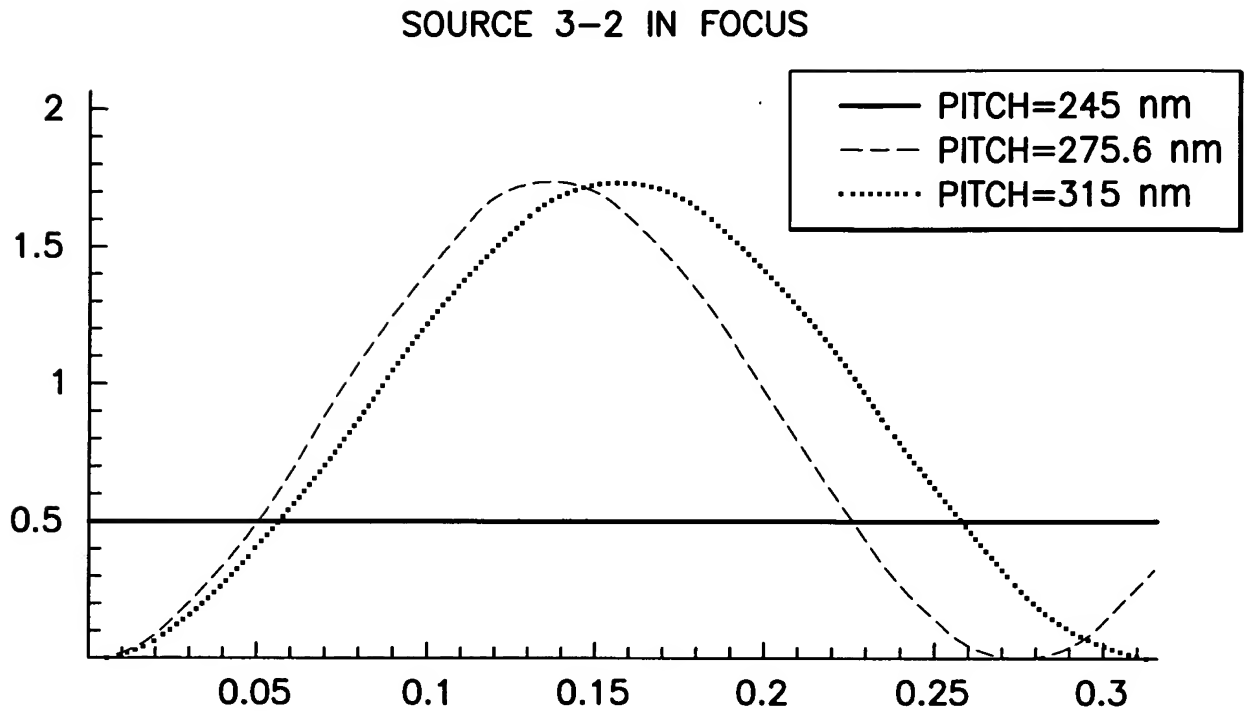

SOURCE 3-2 IN FOCUS
PITCH=245 nm
PITCH=275.6 nm
PITCH=315 nm
2
1.5
1
0.5
0.05
0.1
0.15
0.2
0.25
0.3

FIG.9

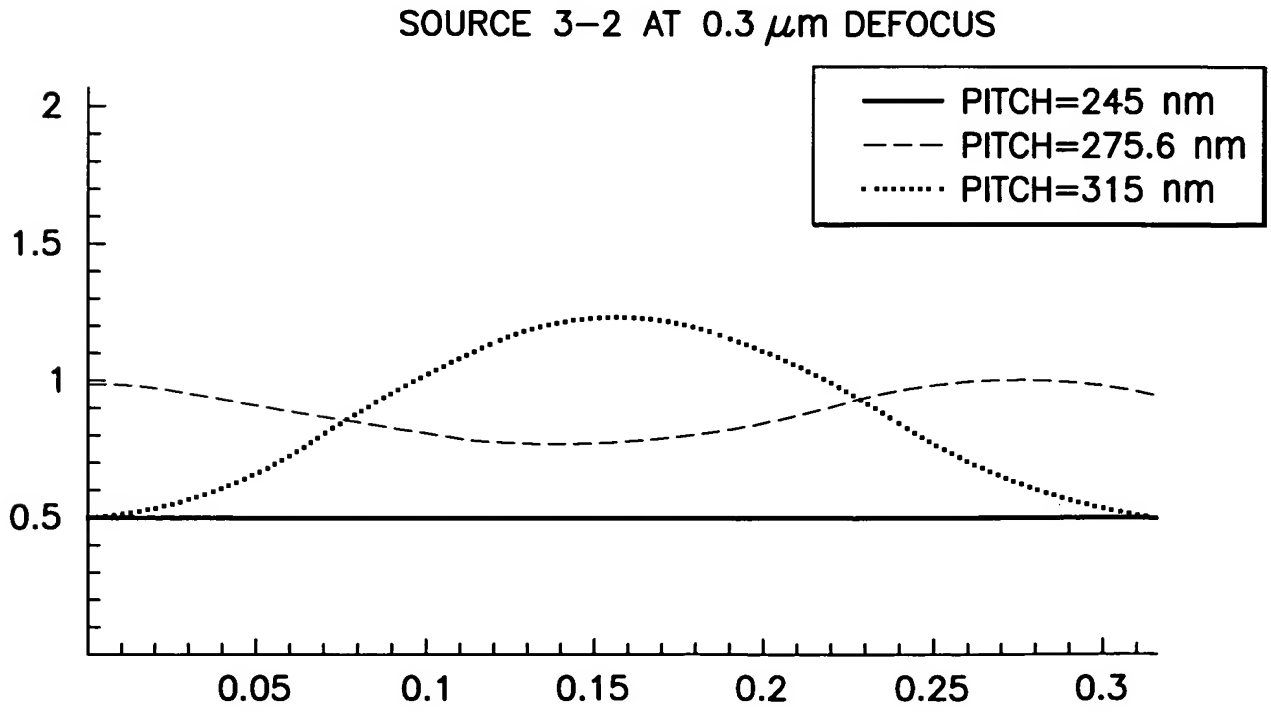

SOURCE 3-2 AT 0.3 μm DEFOCUS
PITCH=245 nm
PITCH=275.6 nm
PITCH=315 nm
2
1.5
1
0.5
0.05
0.1
0.15
0.2
0.25
0.3

FIG.10

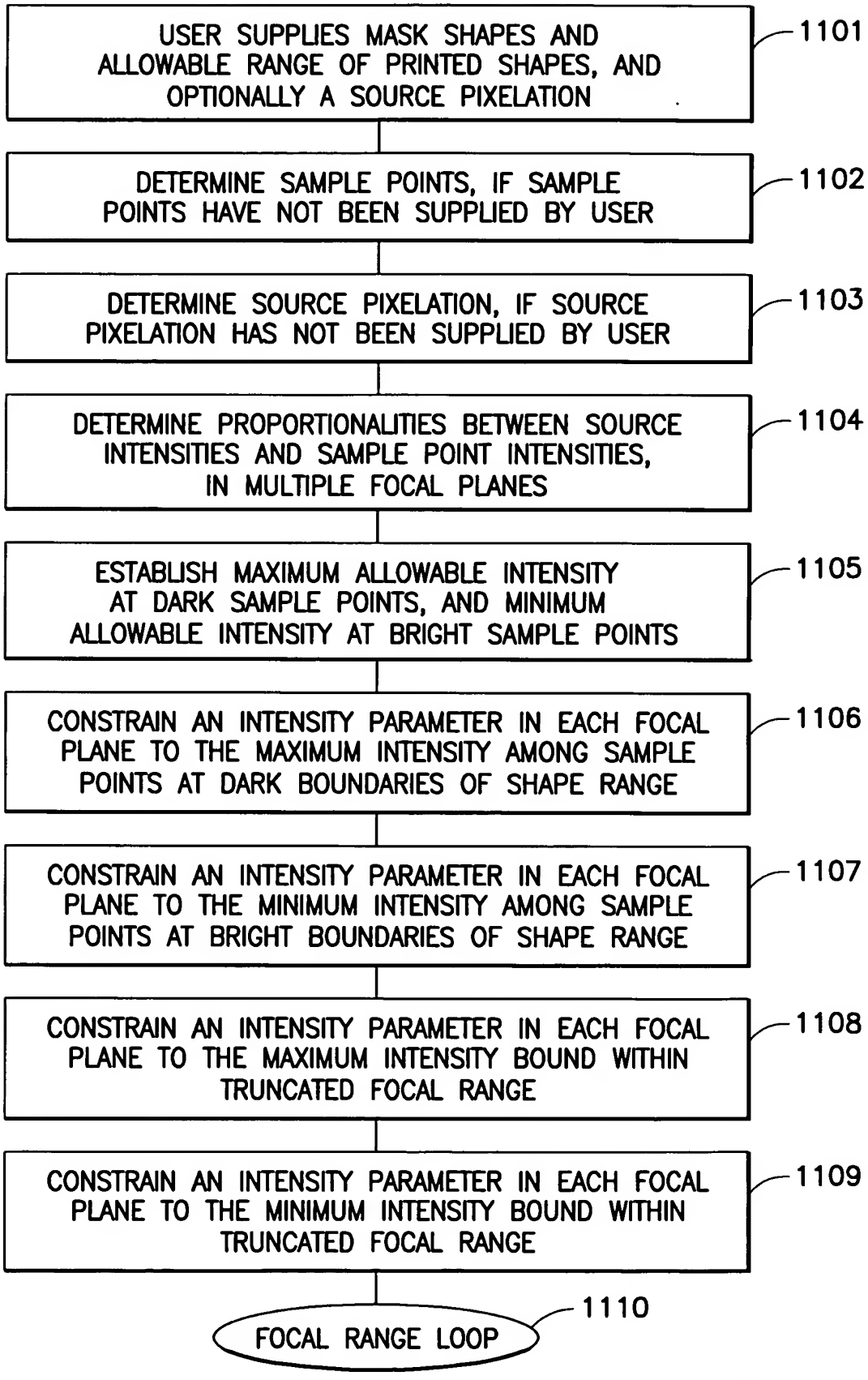
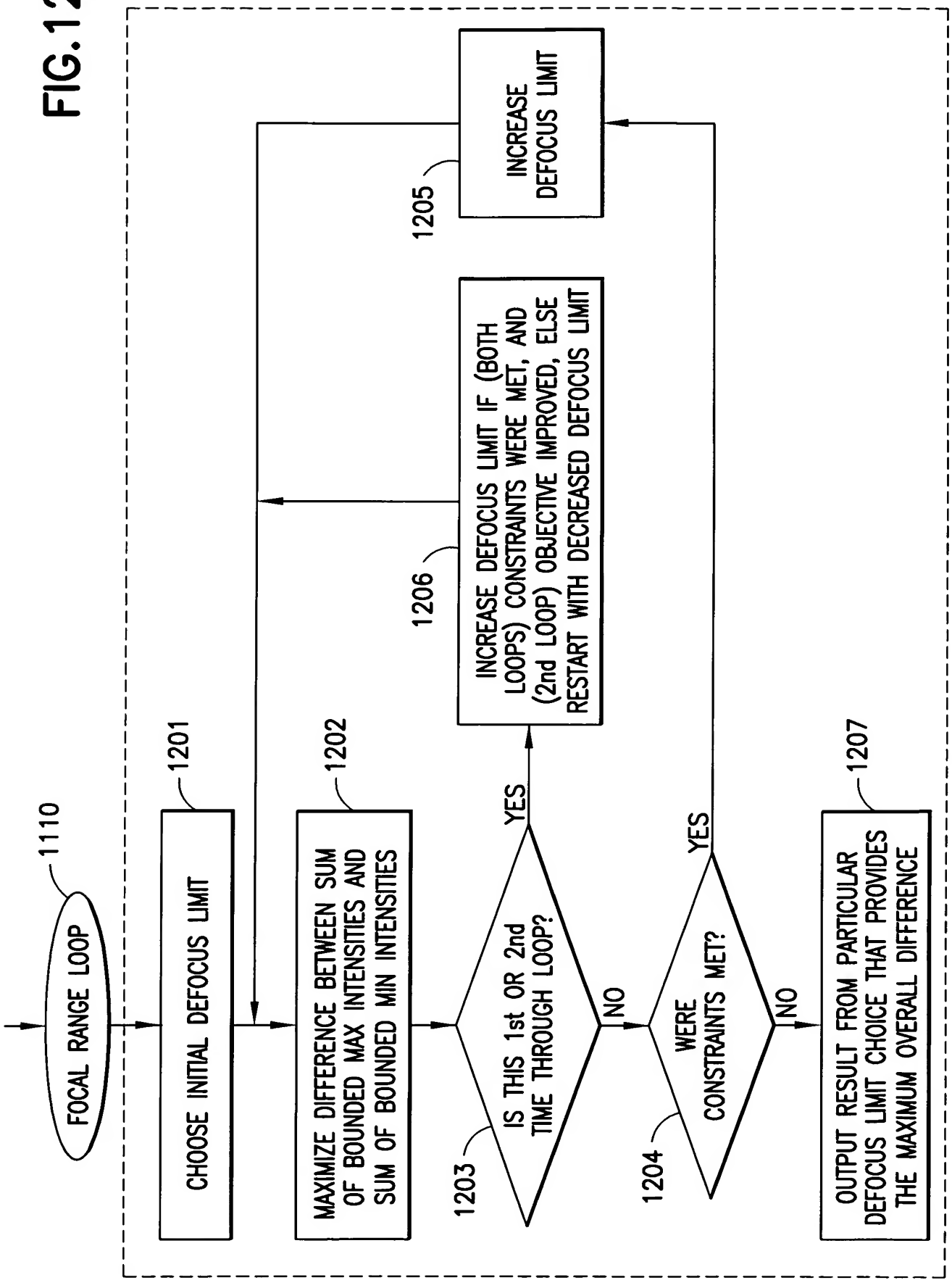
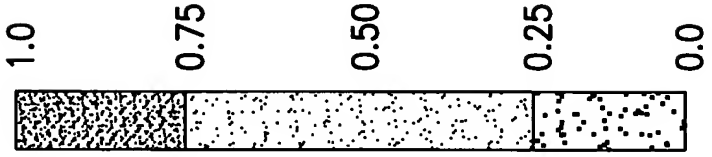

USER SUPPLIES MASK SHAPES AND ALLOWABLE RANGE OF PRINTED SHAPES, AND OPTIONALLY A SOURCE PIXELATION
1101
DETERMINE SAMPLE POINTS, IF SAMPLE POINTS HAVE NOT BEEN SUPPLIED BY USER
1102
DETERMINE SOURCE PIXELATION, IF SOURCE PIXELATION HAS NOT BEEN SUPPLIED BY USER
1103
DETERMINE PROPORTIONALITIES BETWEEN SOURCE INTENSITIES AND SAMPLE POINT INTENSITIES, IN MULTIPLE FOCAL PLANES
1104
ESTABLISH MAXIMUM ALLOWABLE INTENSITY AT DARK SAMPLE POINTS, AND MINIMUM ALLOWABLE INTENSITY AT BRIGHT SAMPLE POINTS
1105
CONSTRAIN AN INTENSITY PARAMETER IN EACH FOCAL PLANE TO THE MAXIMUM INTENSITY AMONG SAMPLE POINTS AT DARK BOUNDARIES OF SHAPE RANGE
1106
CONSTRAIN AN INTENSITY PARAMETER IN EACH FOCAL PLANE TO THE MINIMUM INTENSITY AMONG SAMPLE POINTS AT BRIGHT BOUNDARIES OF SHAPE RANGE
1107
CONSTRAIN AN INTENSITY PARAMETER IN EACH FOCAL PLANE TO THE MAXIMUM INTENSITY BOUND WITHIN TRUNCATED FOCAL RANGE
1108
CONSTRAIN AN INTENSITY PARAMETER IN EACH FOCAL PLANE TO THE MINIMUM INTENSITY BOUND WITHIN TRUNCATED FOCAL RANGE
1109
FOCAL RANGE LOOP
1110

FIG.11

FIG.12


1110
FOCAL RANGE LOOP
1201
CHOOSE INITIAL DEFOCUS LIMIT
1202
MAXIMIZE DIFFERENCE BETWEEN SUM OF BOUNDED MAX INTENSITIES AND SUM OF BOUNDED MIN INTENSITIES
1203
IS THIS 1st OR 2nd TIME THROUGH LOOP?
YES
NO
1206
INCREASE DEFOCUS LIMIT IF (BOTH LOOPS) CONSTRAINTS WERE MET, AND (2nd LOOP) OBJECTIVE IMPROVED, ELSE RESTART WITH DECREASED DEFOCUS LIMIT
1204
WERE CONSTRAINTS MET?
YES
NO
1205
INCREASE DEFOCUS LIMIT
1207
OUTPUT RESULT FROM PARTICULAR DEFOCUS LIMIT CHOICE THAT PROVIDES THE MAXIMUM OVERALL DIFFERENCE

GLOBALLY OPTIMIZED SOURCE TO MAXIMIZE COMMON WINDOW. CD IS 87.5 nm, WITH +/-9% CD TOLERANCE. PITCHES ARE 245nm - 315nm, NA=0.75, λ =193 nm



PROCESS WINDOW IS 24.1%-μm
10% PUPIL FILL (WITHIN δ=0.88),
VERTICAL PATTERNS

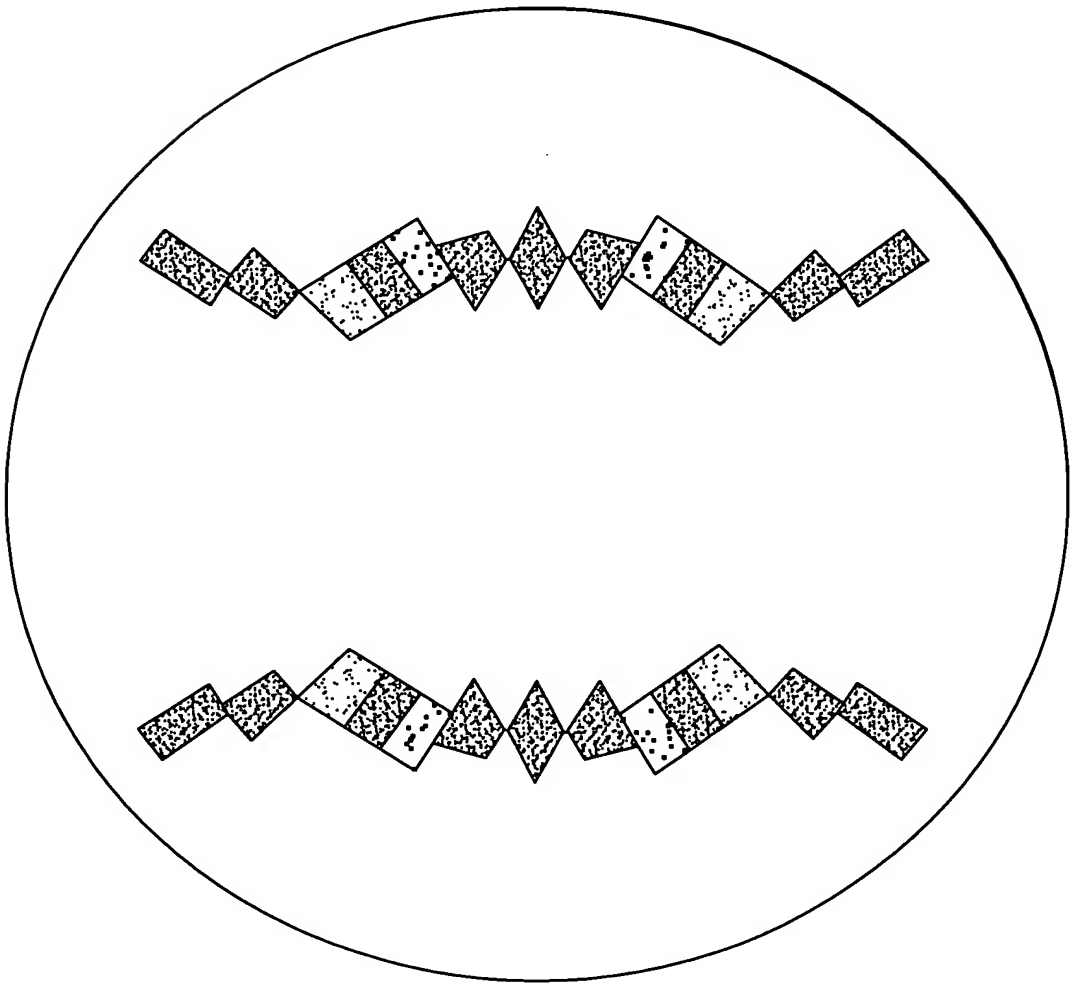


FIG.13

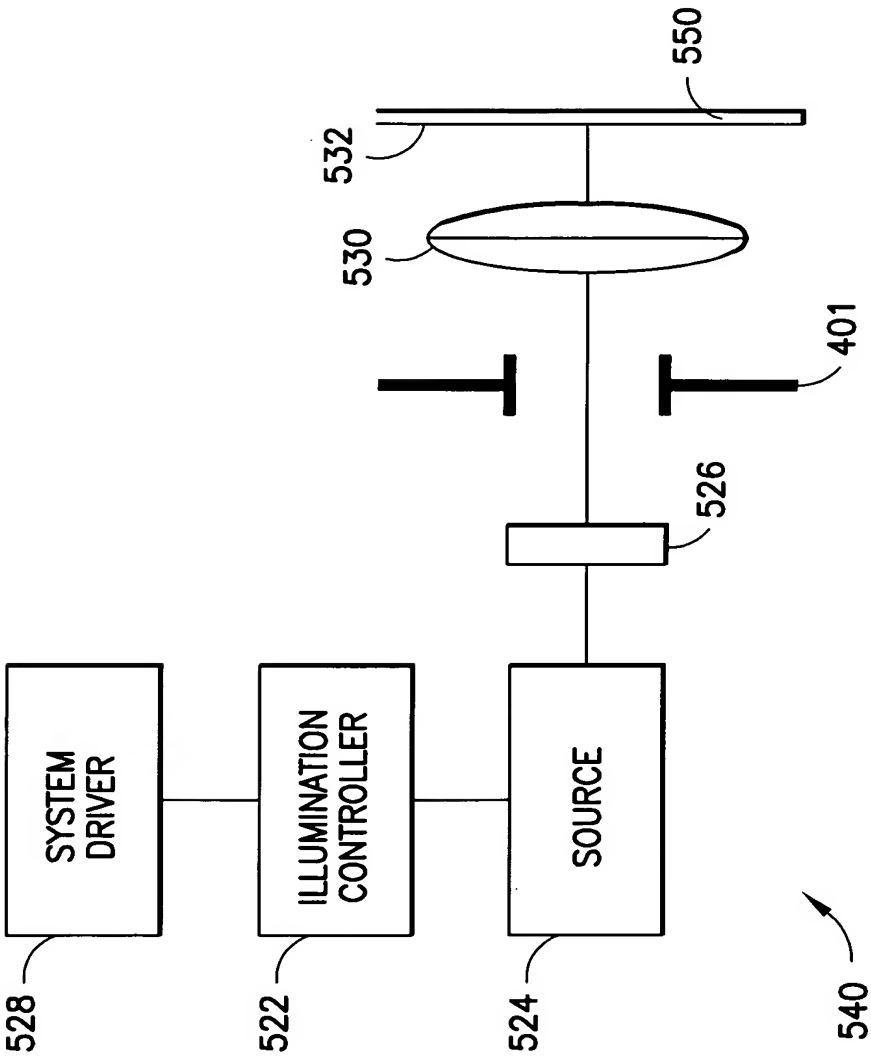

550
532
530
401
526
SYSTEM DRIVER
ILLUMINATION CONTROLLER
SOURCE
528
522
524
540

FIG.14